



U.S. Department of Energy  
Energy Efficiency and Renewable Energy

# DOE Solid State Lighting Status and Overview

James R. Brodrick, Ph.D.  
US Department of Energy  
Office of Energy Efficiency and Renewable Energy  
Buildings Technologies Program

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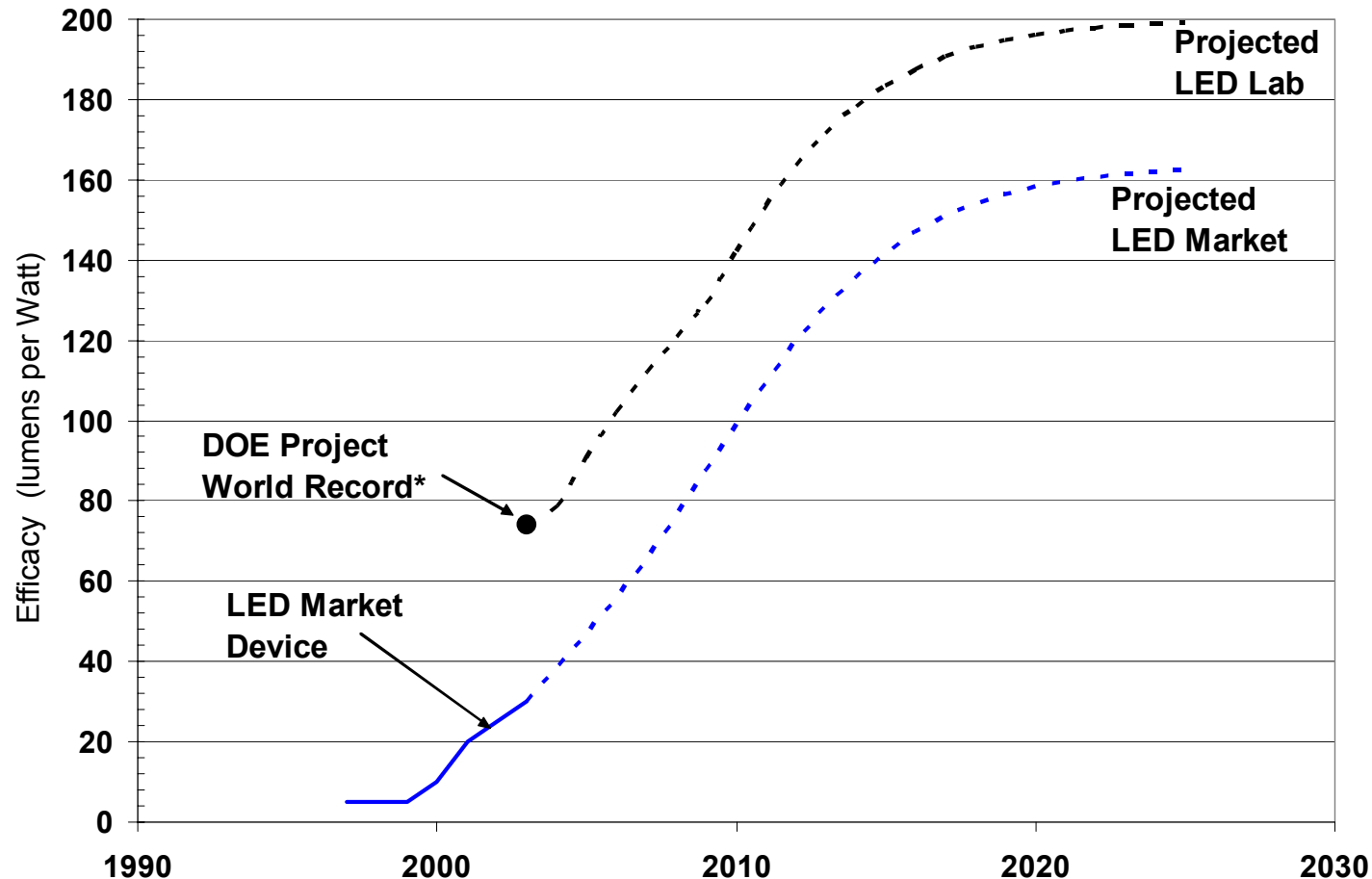
# **Mission Statement**

## **Solid-State Lighting Program Mission**

**Guided by a government-industry partnership, the mission is to create a new market for high-efficiency, general illumination products through the advancement of semiconductor technologies, to save energy and enhance the quality of the lighted environment.**



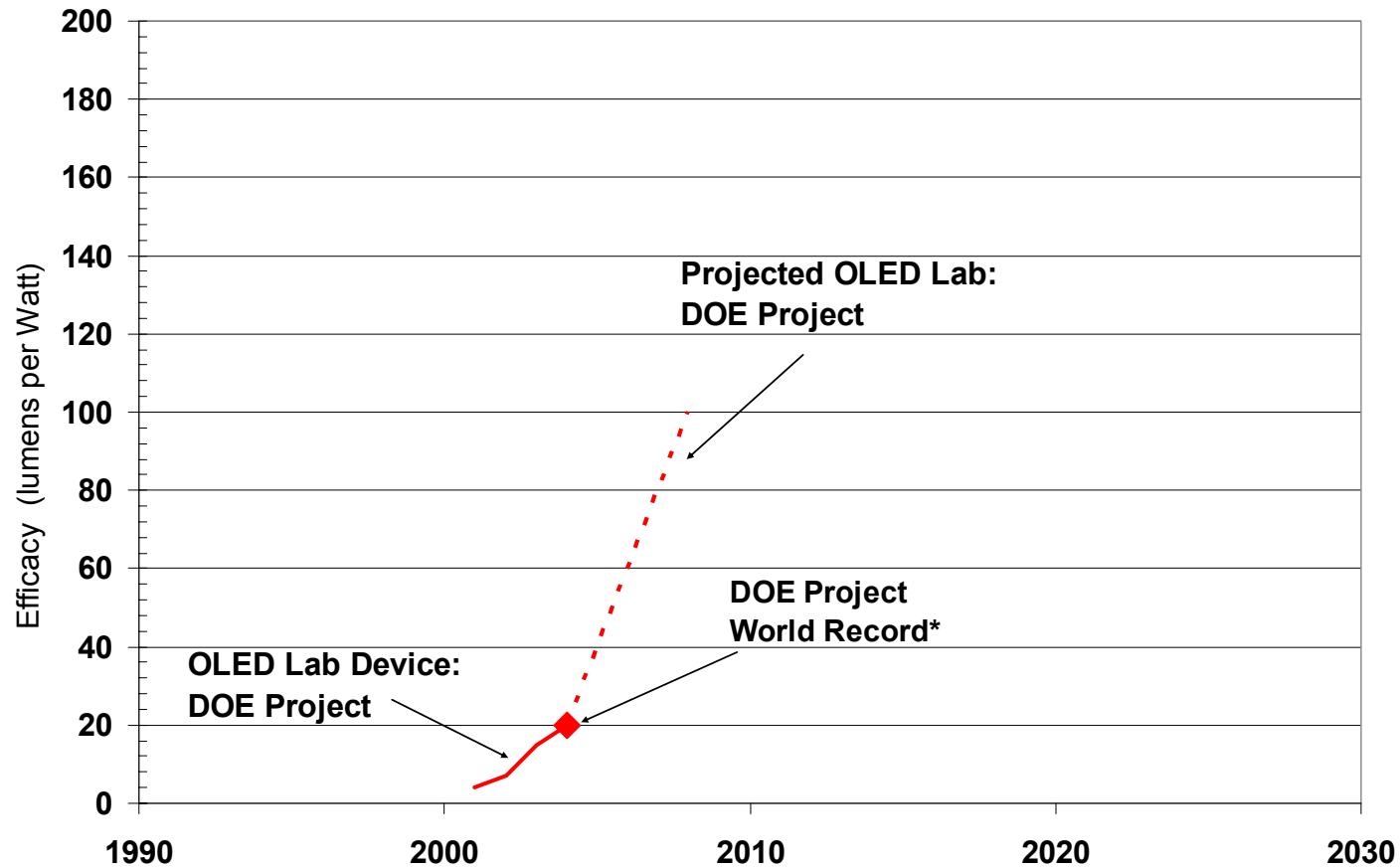
# White-Light LED Efficacy Targets



\* Note: World record represents a 74 lumen per Watt white-light LED laboratory device



# White-Light OLED Efficacy Targets



\* Note: World record represents a 20 lumen per Watt white-light OLED laboratory device



# SSL Research Agenda

Ideas

*What Is the intended outcome?*

## Core Technology

- Scientific research efforts to seek more comprehensive knowledge or understanding of a subject
- Possible multiple applications or fields of use in mind
- Activities include: theory, fabrication, and measurement of a material
- Tasks are truly innovative: fill technology gaps, provide enabling knowledge or data, represent a significant advance in knowledge base

## Product Development

- Systematic use of knowledge gained from basic or applied research to develop or improve commercially viable materials, devices, or systems
- Laboratory testing is conducted on prototypes. Feedback used to improve prototype design.
- Along with technical activities, market and fiscal studies performed to ensure successful transition to commercialization



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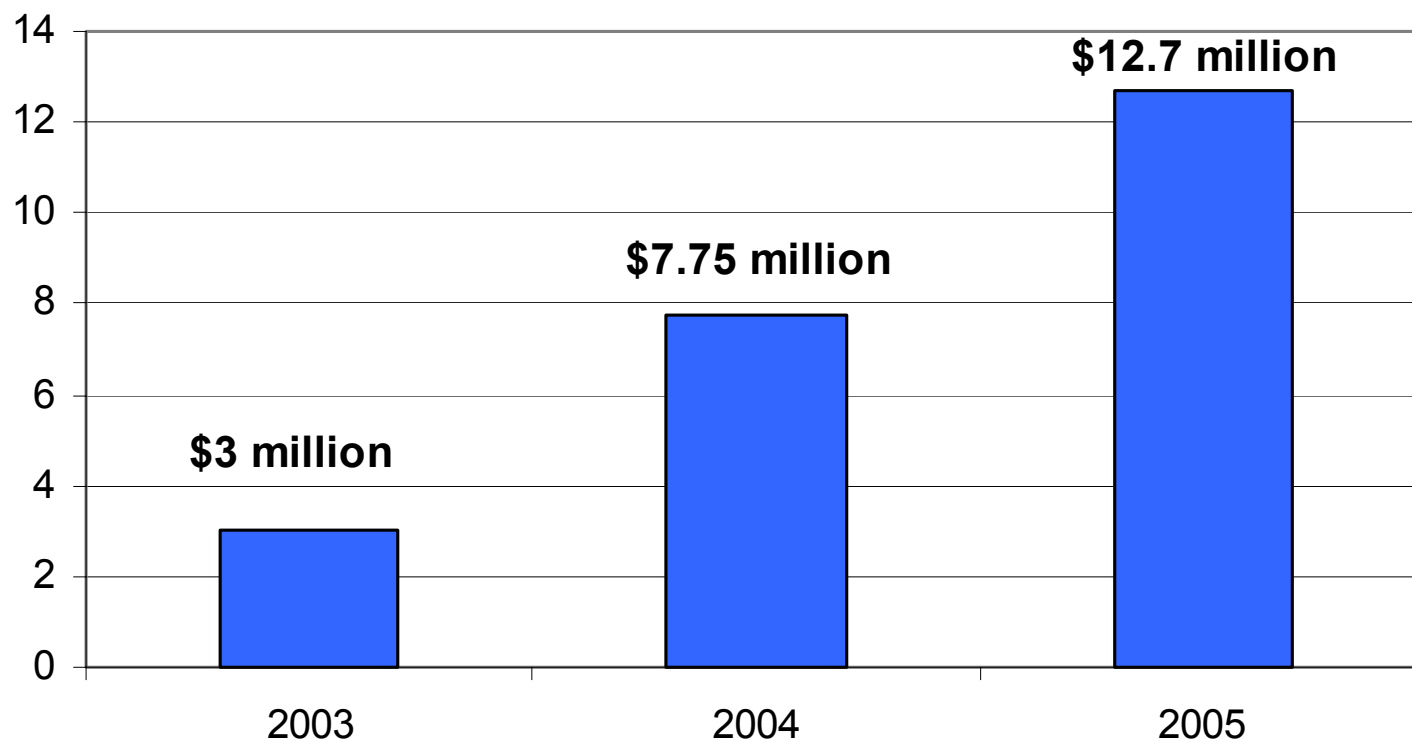
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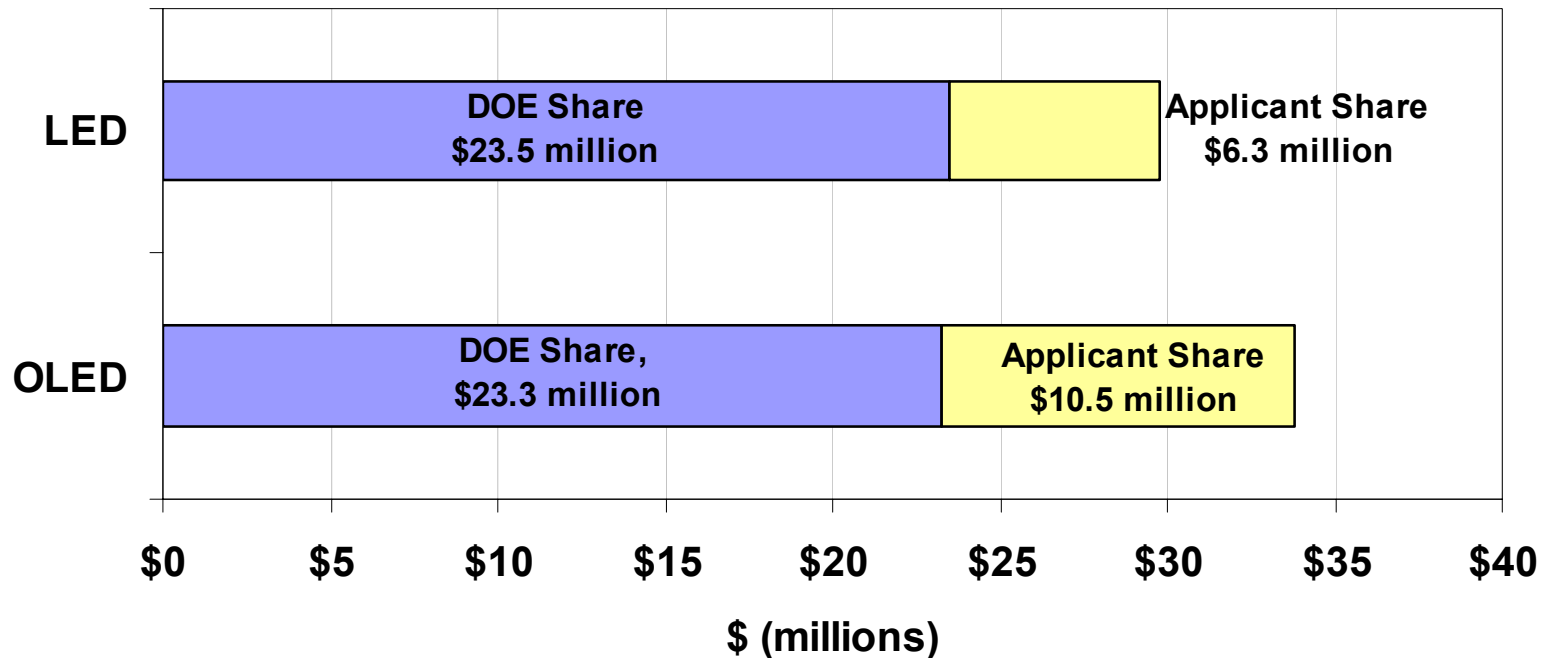
## Congressional Appropriation (\$million)







## SSL R&D Project Funding



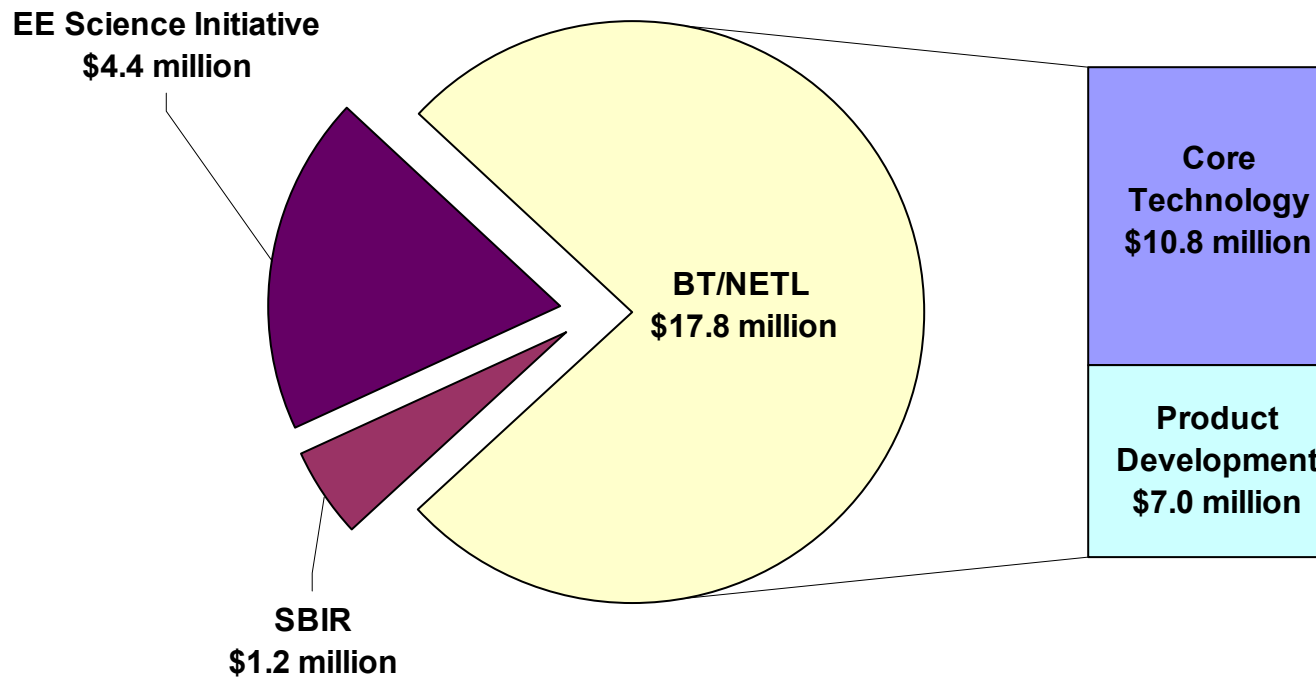
Total Contract Value of Projects: \$63.6 million\* (42 projects)

- LED: \$29.8 million (23 projects)
- OLED: \$33.8 million (19 projects)

\* The total contract value includes DOE funding (\$46.8 million) and applicant cost-share (\$16.8 million)



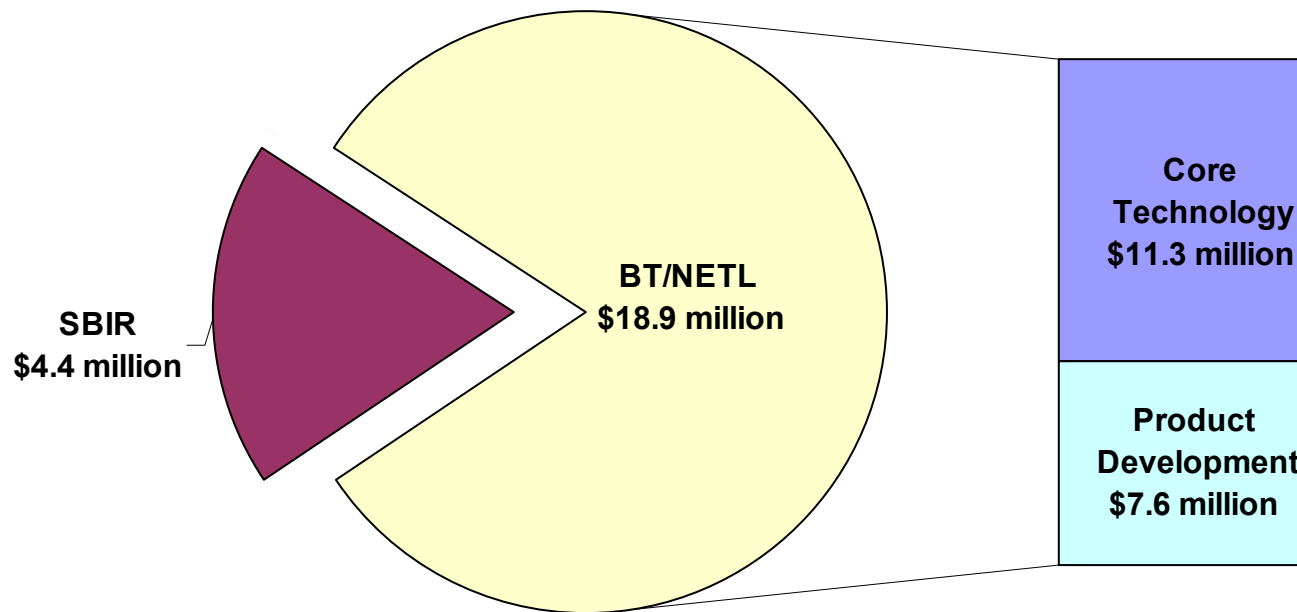
# LED Project Funding Mechanisms



- DOE funds a total of \$23.5 million in LED research.



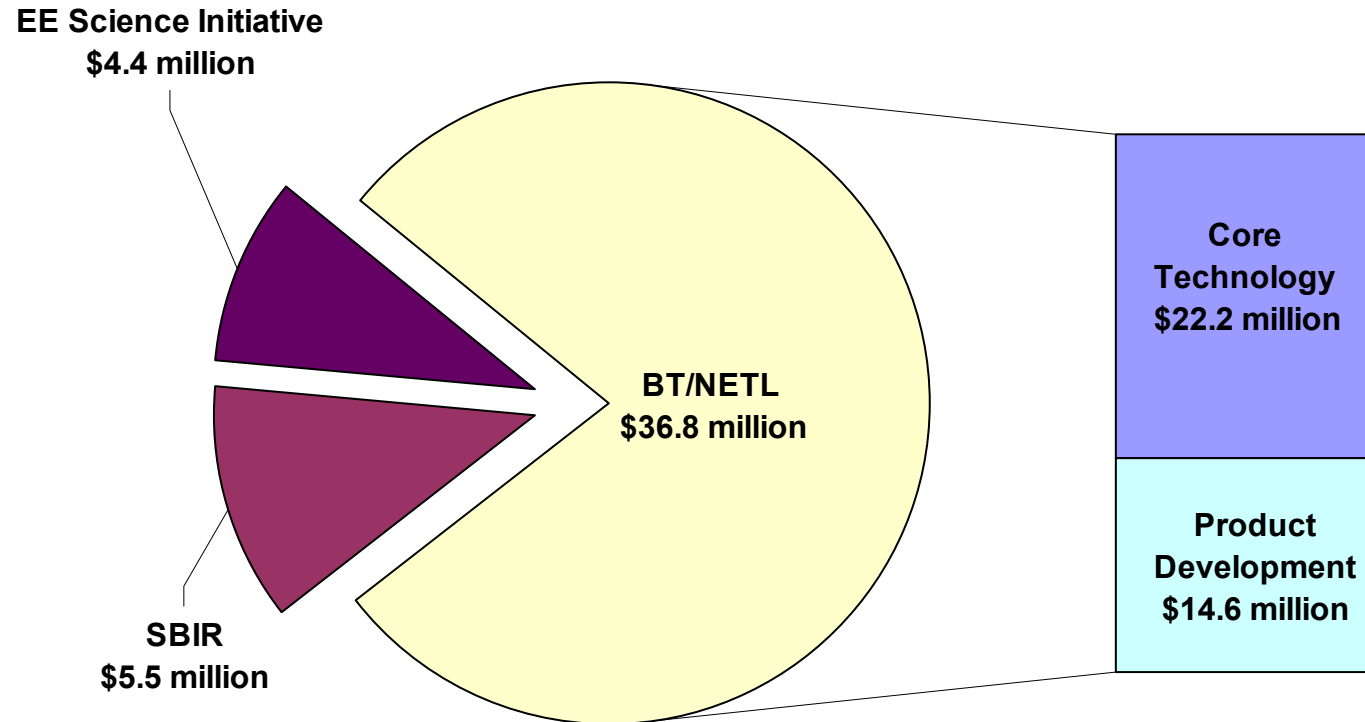
# OLED Project Funding Mechanisms



- DOE funds a total of \$23.3 million in OLED research.



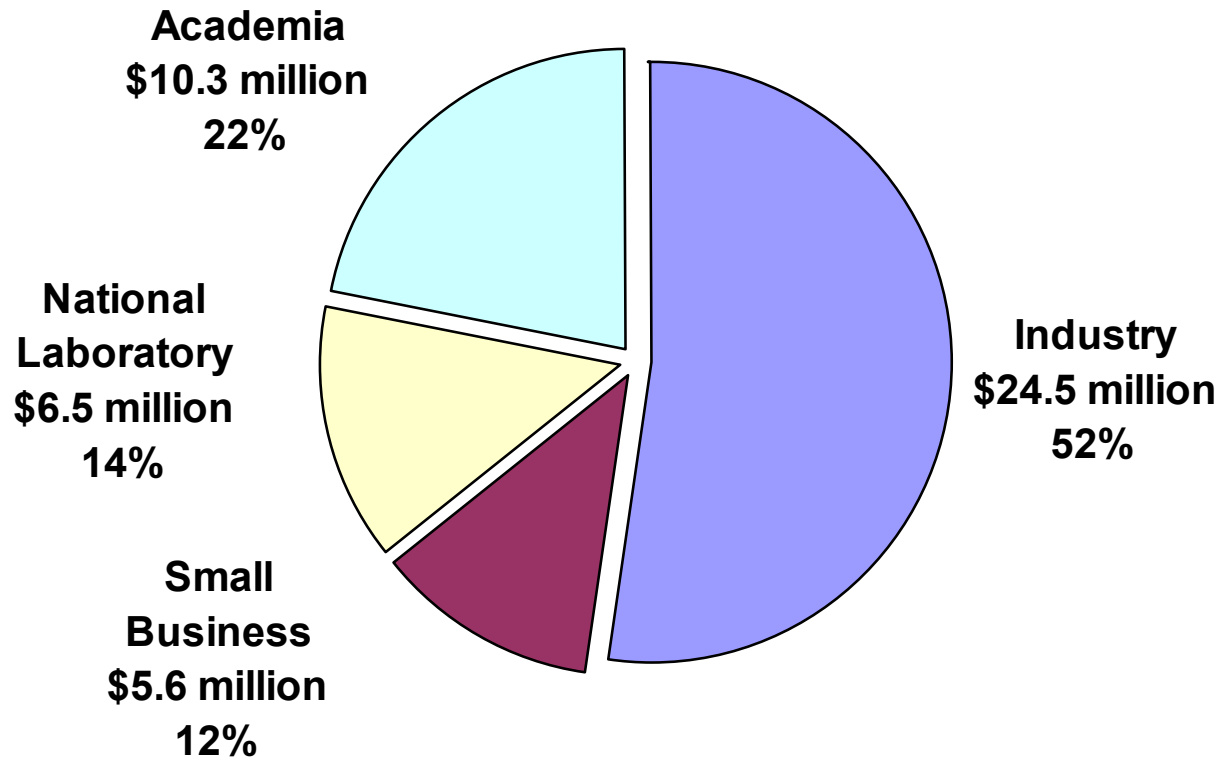
# SSL Project Funding Mechanisms



- DOE funds a total of \$46.8 million in solid-state lighting research.



## Recipients of DOE Funding



- The Department funds solid-state lighting research in partnership with industry, academia, and national labs.



## Core Technology Awards in FY'04

	Total # of Projects	\$ Funding (million)
<b>Light Emitting Diode</b>		
High efficiency visible and near UV (<380nm) semiconductor technology materials for LED general illumination technology	5	\$4.4
Advanced architectures & high power conversion efficiency emitters	0	0
High temperature, efficient, long-life phosphors, luminescent materials for wavelength conversion & encapsulants	1	\$2.5
<b>Organic Light Emitting Diode</b>		
High efficiency, low voltage, stable materials for OLED general illumination technology (hosts, dopants, and transport layers)	4	\$7.0
Strategies for improved light extraction and manipulation	0	0
Novel device structures for improved performance & low cost	1	\$2
<b>Total</b>	<b>11</b>	<b>\$15.9</b>



## Product Development Awards in FY'04

	Total # of Projects	\$ Funding (million)
<b>Light Emitting Diode</b>		
SSL luminaire design and materials	2	\$2.7
High efficiency, reliable, intelligent electronics for SSL	1	\$1.6
<b>Organic Light Emitting Diode</b>		
SSL luminaire design and materials	2	\$5.3
High efficiency, reliable, intelligent electronics for SSL	0	0
<b>Total</b>	<b>5</b>	<b>\$9.6</b>



## Total Portfolio: Core Technology

	Total # of Projects	\$ Funding (million)
<b>Light Emitting Diode</b>		
High efficiency visible & near UV (<380nm) semiconductor technology materials for LED general illumination technology	10	\$6.7
Advanced architectures & high power conversion efficiency emitters	3	\$3.5
High temperature, efficient, long-life phosphors, luminescent materials for wavelength conversion & encapsulants	7	\$8.6
<b>Organic Light Emitting Diode</b>		
High efficiency, low voltage, stable materials for OLED general illumination technology (hosts, dopants, & transport layers)	9	\$8.8
Strategies for improved light extraction & manipulation	2	\$0.85
Novel device structures for improved performance & low cost	5	\$3.7
<b>Total</b>	<b>36</b>	<b>\$32.2</b>



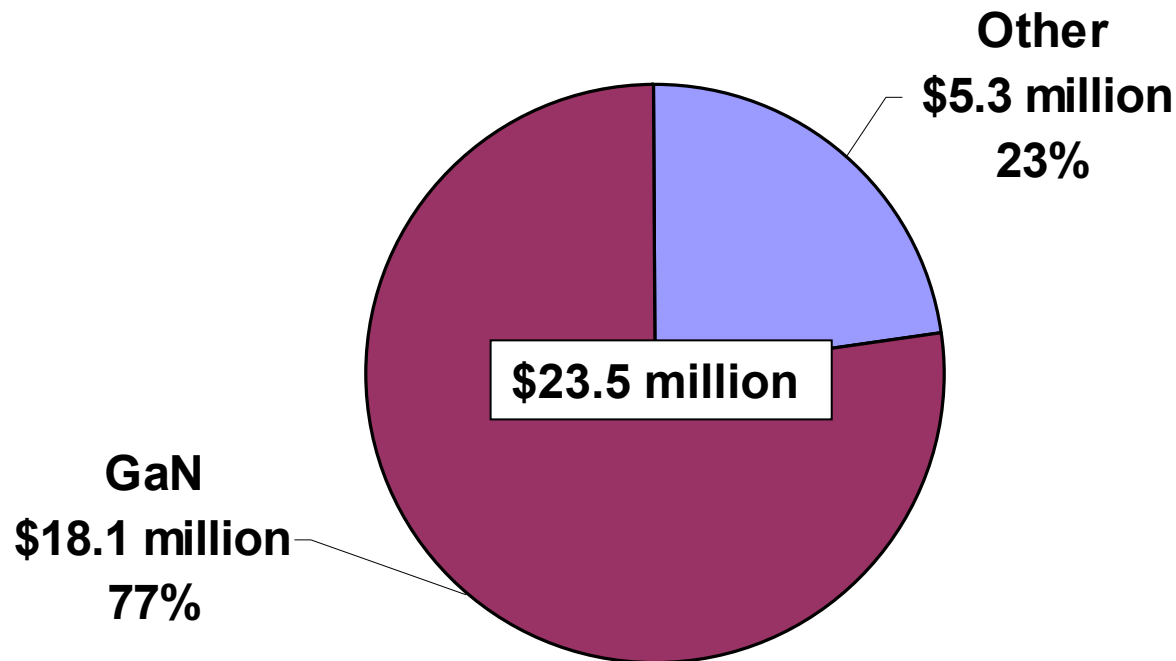


# Total Portfolio: Product Development

	Total # of Projects	\$ Funding (million)
<b>Light Emitting Diode</b>		
SSL luminaire design and materials	2	\$3.1
High efficiency, reliable, intelligent electronics for SSL	1	\$1.6
<b>Organic Light Emitting Diode</b>		
SSL luminaire design and materials	3	\$9.9
High efficiency, reliable, intelligent electronics for SSL	0	0
<b>Total</b>	<b>6</b>	<b>\$14.6</b>



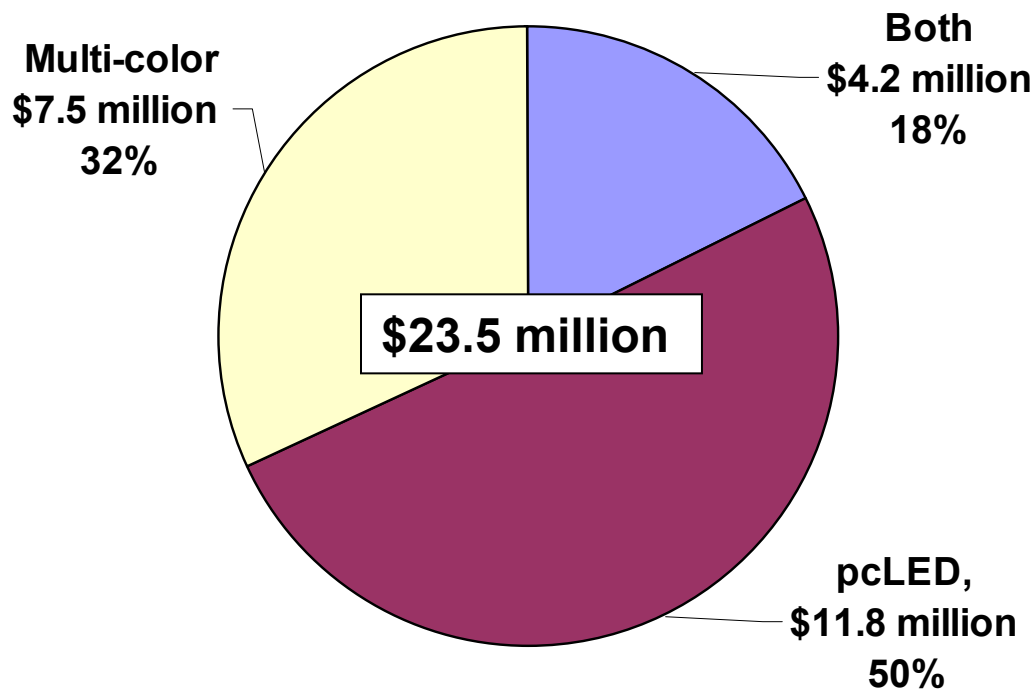
# Compound Semiconductor Materials Systems



- Of the 23 LED projects, 19 involve research with Gallium Nitride (GaN) materials systems, and 4 involve work with other III-V material systems.



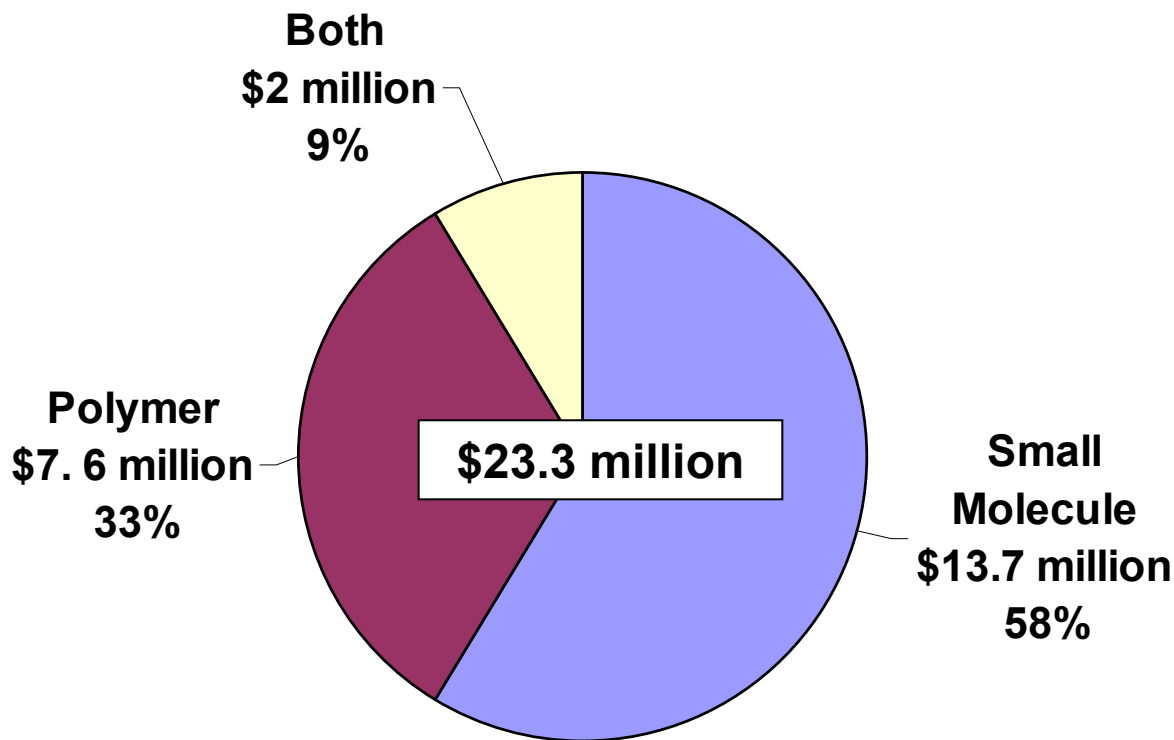
# Methods for Creating White Light



- Of the 23 LED projects, 6 are studying multi-color systems, 11 are researching pcLED systems, and 6 are studying technologies that could apply to either method of creating white light.



# OLED Material Systems



- Of the 19 OLED projects, 15 projects are researching small molecule OLEDs, three are researching polymer OLEDs and one could apply to either OLED material system.



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# DOE SSL Commercialization Support

- Pull efficient products into the market
- Meeting held with “energy”- organizations
- Alliance, NEMA, ALA, others
- Tactics:
  - Energy Star™
  - Design Competition
  - Utility Promotion
  - Procurement
  - Consumer Information
  - Other